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Abstract title: The Atmospheric Calibration System for Cassini Radio Science: Part 2

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Abstract:

A new media calibration system is currently being implemented in the NASA Deep Space Network (DSN) and is intended to calibrate the both the dry and wet components of the neutral atmosphere. Fluctuations in path delay due to atmospheric water vapor will dominate the error budget for several radio science and radio astronomy experiments. The first use of this system will be with the Gravitational Wave Experiment on the Cassini spacecraft. In order to demonstrate the performance of the media calibration system we have installed two of them near two DSN antennas which operate as a radio interferometer and then compared the estimates of path delay provided by the media calibration system to the delay fluctuations as seen by the interferometer. In this report we describe in the preliminary analysis of a series of experiments that started in August 1999 in which we used various observing strategies and sampled a variety of meteorological conditions. In almost all cases, the media calibration provided improvement when applied as corrections to the residual fluctuations of the interferometer. At times, this improvement is very dramatic (factor of 6). The data indicate that the media calibration system is capable of better than 3×10^{-15} on time scales longer than a few thousand seconds as measured by the Allen Standard Deviation. The data comparison seems to be limited by systematic effects in the interferometer.